

Description

INTERNET ACCESS TO TELECOMMUNICATIONS RELAY SERVICE

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This is a non-provisional counterpart and claiming benefit of U.S. Provisional Application Serial No. 60/424,164, filed November 6, 2002, said provisional application being incorporated in its entirety herein by reference.

BACKGROUND OF INVENTION

[0002] The Americans for Disabilities Act of 1990 requires that any company providing inter-exchange telecommunications services must provide access to people with disabilities. This law requires that all telephone companies in the United States and its possessions must provide access to people with disabilities including those that are deaf, hard of hearing and speech impaired. All states are required to establish TRS (Telecommunications Relay Service) for these individuals. Essentially, TRS connects those who can hear and speak with those who can't via the telephone

network.

[0003] Typically, a person who is deaf, hard of hearing or speech impaired accesses TRS with a device known as a TTY (Teletype Device) or TDD (Telecommunications Device for the Deaf). TTYs have a single or multiple line display with a keyboard and a modem to connect to a telephone line. Deaf individuals have communicated with each other over the telephone network since the late 1960s with these devices. Communications with these devices are accomplished by typing on a keyboard and have the words appear on the TTY displays of both parties. Some TTYs have a printer attached to allow printing of the conversation.

[0004] TRS centers bridge the gap between people with TTYs and those who use telephone sets (POTS) to communicate over the telephone network. A TRS center is a call center that has from ten to hundreds of relay operators, known as Communications Assistants (CA). These CAs each work at a terminal and receive calls from TTY users requesting to call a person with normal speech and hearing (voice person). The CA will place calls for these individuals and relay the exact conversation. In other words, the CA will read the text received from the TTY user to the voice person and type the response from the voice person back to the

TTY user. A CA can also receive a call from a voice person who desires to call a person with a TTY.

[0005] TRS users access the TRS by dialing a toll free number or by dialing 711. Each state either has its own TRS center or contracts with a center in another state to handle TRS traffic. The cost to operate these centers are normally paid for by the companies providing inter-exchange telephone services in that state.

[0006] The present invention is a method and a system that will allow a person to access a TRS center via an Internet terminal on the World Wide Web instead of using a TTY device on the telephone network.

BRIEF DESCRIPTION OF DRAWINGS

[0007] FIG. 1 is a schematic of a current typical TRS operator platform.

[0008] FIG. 2 is a schematic of a current typical TRS center.

[0009] FIG. 3 is a schematic of a typical TRS center that would use the present invention.

[0010] FIG. 4 is a schematic of the internet server.

[0011] FIG. 5 is a message flow diagram showing the interaction between the customer's internet terminal, the nationwide routing server, and the TRS center packet server.

- [0012] FIG. 6 is a flowchart for the customer's terminal application.
- [0013] FIG. 7 is a flowchart for the nationwide routing server application.
- [0014] FIG. 8 is a flowchart for the TRS center packet server application.
- [0015] FIG. 9 is a flowchart for the TRS operator's application.

DETAILED DESCRIPTION

- [0016] The diagram of a conventional CA operator platform is shown in FIG. 1. Notice that there are two analog telephone line connections. One is used for the incoming caller and one is used for the outgoing caller. These connections need to be analog as opposed to digital because a modem connection to the telephone line will be required. A typical current TRS system diagram is shown in FIG. 2. This shows how the position is connected to a PBX. Typical call flow is as follows:
- [0017] – The CA logs into the platform and sets status as available to take calls.
- [0018] – The position is registered in the PBX as available and put in the queue to accept calls.
- [0019] – Customer dials an 800 number for the PBX and arrives

at the PBX via the PSTN.

- [0020] – Call is routed to the next available CA in queue via an incoming analog telephone line to the CA's platform.
- [0021] – The CA obtains the *calling-to* number from the customer.
- [0022] – The CA dials the *calling-to* number and begins relaying the conversation.
- [0023] Internet Access capability can be added to the TRS center by installing the additional equipment shown in FIG. 3, *i.e.*, a TRS Packet Server and a router connected to the internet. In addition, modifications to the software on the TRS Operator Platform will be required to communicate with the new TRS Packet Server. Typical call flow for a TRS call arriving through Internet Access will be the same as discussed above but with the following additions:
 - [0024] – The CA position logs into the TRS Packet Server at the same time it logs into the PBX.
 - [0025] – The position will also be put in queue in the TRS Packet Server.
 - [0026] – When a call request arrives at the Packet Server, a *call arrival* message will be sent to the next available CA position via the LAN.
 - [0027] – If the position has not received a call via the PBX, a *call accept* message will be sent back to the Packet Server and

at the same time the CA position will issue a *make busy* command to the PBX. The position will now process the TRS call for the internet customer.

[0028] – If the position has received a call while in queue at the PBX, a *cancel call* command will be sent to the Packet Server. The Packet Server will then select another CA position and send a new *call arrival* message to the position.

[0029] It is important to note that the criteria for selecting a position to receive a call in the Packet Server should be different than that in the PBX. Most PBXs use a selection process known as *most idle* selection. That is, position that is logged into the PBX queue for the longest amount of time without receiving a call receives the next call. The Packet Server will also maintain a queue of available positions. If a call arrives at the PBX via the PSTN and a call arrives via the Packet Server at the same time, it is possible for the same CA position to be selected by both the PBX and Packet Server to receive the calls. In order to minimize this possibility, the threshold in the Packet Server queue should be set to a higher level than the PBX queue.

[0030] FIG. 4 shows a diagram on how multiple TRS centers can be connected to the Internet. One Nationwide TRS Routing Server will receive *call requests* from special software in–

stalled on customer's Internet terminals. This *call request* is a TCP packet that will contain as a minimum the following information: the customer's IP address, the number the customer wants to dial through TRS (*calling-to* number) and customers account number. The Routing Server will then assign this customer a serial number and then select a TRS center based on the calling to number and send a call request packet to the Packet Server at that center. This packet will contain the customer's serial number. If there are operators available to take calls at that center, a *call-accept* message will be sent back to the Routing Server with the customer's serial number, the IP address and TCP port of the routing server will be included for the customer to establish connection on. This information will then be forwarded back to the requesting customer. At this point the customer's software will send the *call request* packet directly to the TRS Packet Server using the IP address and TCP port information contained in the *call accept* packet. A secure connection will then be established using SSL or some other encryption method. A CA position will be selected and the TRS call can then proceed. A diagram of the message flow is shown in FIG. 5. The total from when the customer sends the *call request* packet to the

Routing Server until a CA begins dialing the request should take less than three (3) seconds if there are CAs available in queue to take the call.

[0031] Referring to FIG. 5, the flow is as follows:

[0032] 1. The customer establishes a secure connection to the Nationwide Routing Server.

[0033] 2. The Nationwide Routing Server responds with an acknowledgment that a secure connection has been established.

[0034] 3. The customer issues a request for a TRS Operator to dial a number and initiate a telephone call.

[0035] 4. The Nationwide Routing Server queries the data base for the appropriate TRS Center based upon where the call is to be placed. For example, if the customer wishes to dial a number in New York City, the Nationwide Routing Server designates the New York center. Typically, a single center handles several states. This step is shown in FIG. 7.

[0036] 5. The Nationwide Routing Server queries the specific TRS Packet Server (*e.g.*, New York) to determine whether an operator is available to place the call. If no operator is available, then optionally:

[0037] a. Another center can be queried; or,

- [0038] b. An ALL OPERATORS BUSY message can be sent to the customer.
- [0039] 6. If an operator is available, the TRS Packet Server informs the Nationwide Routing Server that the TRS Center is prepared to accept the call, and an operator is assigned.
- [0040] 7. The Nationwide Routing Server informs the customer that the call is ready to proceed. The *call-accept* packet has the IP address of the chosen TRS Packet Server and the position number of the chosen operator.
- [0041] 8. A direct secure encrypted duplex connection is established between the customer and the chosen TRS Packet Server. At this time, the customer no longer communicates with the Nationwide Routing Server for this call.
- [0042] 9. The customer issues a formal request to dial a number.
- [0043] 10. The TRS Packet Server acknowledges that the call has been dialed. It reports back to the customer with a RINGING, BUSY, or INVALID (NOT IN SERVICE) message.
- [0044] 11. If the called party answers, the relay call is processed between the customer (who types his responses) and the hearing party (who speaks). The operator mediates between the two parties by speaking to the hearing party and typing responses to the customer.
- [0045] 12. When the call is complete, the customer issues a

HANG-UP request.

[0046] 13. The TRS Packet Server acknowledges HANG-UP to the customer.

[0047] In a typical application, the customer uses a conversation window not unlike that of a typical chat or instant messaging application. In fact, the software can be integrated with AOL Instant Messaging Software since the entry points and interface specifications are publicly known.

[0048] There are four software components to this system:

[0049] – The Customer's Internet Terminal Application

[0050] – The Nationwide Routing Server Software

[0051] – The TRS Packet Server Software

[0052] – The TRS Operator Platform Software

[0053] Each of the components are linked together by an IP (Internet Protocol) connection. This section provides a functional specification for each software component.

[0054] CUSTOMER'S INTERNET TERMINAL SOFTWARE:

[0055] The Customer's Internet Terminal Software is a custom application that resides on the customer's Internet Personal Computer. This application is essentially a text box that allows the customer to communicate with a TRS Op-

erator once the connection has been established to the TRS Packet Server. A summary of the TCP messages handled are shown in the tables below.

Receive Packets

Message Type	Received From	Description
Nationwide Secure Connection Established	Nationwide Routing Server	Confirmation of secure connection
TRS Server Secure Connection Established	TRS Packet Server	Confirmation of secure connection
Call Accept Packet	Nationwide Routing Server	Call has been placed to a TRS Operator and the TRS Operator has dialed the outbound party
TRS Operator Data	TRS Packet Server	Contains information text typed by the TRS Operator
Log Off Acknowledgement	TRS Packet Server	The outbound party has hung up.
Acknowledgement	TRS Packet Server	Acknowledgement packet
Error Packet	TRS Packet Server	Error condition

Transmit Packets

Message Type	Sent To	Description
Establish Secure Connection to the Nationwide Routing Server	Nationwide Routing Server	Establish Secure Connection to Nationwide Routing Server
Call Request	Nationwide Routing Server	Originate a call
Establish Secure Connection to a TRS Packet Server	TRS Packet Server	Establish a secure connection to the TRS Packet Server
Dial Request	TRS Packet Server	Initiate a call to an outbound party
Customer Data Packet	TRS Packet Server	Customer-typed conversation text
Hang-up Request Packet	TRS Packet Server	Requests that operator disconnect the call
Acknowledgement	TRS Packet Server	Acknowledgement packet
Error Packet	TRS Packet Server	Error condition

[0056] FIG. 6 is a flowchart for the customer's internet terminal software.

[0057] 1. Upon initialization, the customer's IP address is noted, and the UI (User Interface) window is displayed.

[0058] 2. The customer issues a dial request to the Nationwide Routing Server.

[0059] 3. If an error occurs, the customer has the option to either

hang-up or to try again. TERMINATE is when the customer aborts the operation or is otherwise disconnected.

[0060] 4. TIME-OUTs occur when the customer takes too long to perform a certain task. These typically issue an error message, and requires the customer to reissue the dial request to the Nationwide Routing Server.

[0061] 5. The customer establishes a secure connection with the Nationwide Routing Server, issues a call request, and receives a *call accept* packet.

[0062] 6. The customer establishes a secure connection with the designated TRS Packet Server. The Nationwide Routing Server will no longer communicate with the customer unless there is a TIME-OUT. Once this connection is established, the dial request and call accept packet is transferred to the TRS Packet Server.

[0063] 7. Once the call is in progress (*i.e.*, the hearing party answers the phone), the customer's terminal is able to communicate with the operator by sending and receiving text.

[0064] 8. When the call is complete, a HANG-UP request is issued, and a HANG-UP acknowledgment is received.

[0065] 9. The customer now has the option of placing a new call without going back to the Nationwide Routing Server.

[0066] NATIONWIDE ROUTING SERVER SOFTWARE:

[0067] The Nationwide Routing Server Software simply provides a means to inform the Customer's Internet Terminal Application if there are any operators available to handle a call. It queries the various TRS Packet Servers at the TRS centers and finds the customer an available TRS Operator. If no operators are available an error message is sent to the customer to inform them that no operators are available and try back later.

Receive Packets

Message Type	Received From	Description
Establish Secure Connection	Customer's Internet Terminal	Request to establish a secure connection
Issue Call Request	Customer's Internet Terminal	Find an available TRS Operator
Call Accept Packet	TRS Packet Server	Agent Available
Error Packet	TRS Packet Server	Indicates Error Condition
Error Packet	Customer's Internet Terminal	Indicates Error Condition

Transmit Packets

Message Type	Sent To	Description
Nationwide Secure Connection Established	Customer's Internet Terminal	Confirmation of secure connection
Status Request Packet	TRS Packet Server	Confirmation of secure connection
Call Accept Packet	Customer's Internet Terminal	Call has been placed to a TRS Operator and the TRS Operator has dialed the outbound party
Error Packet	TRS Packet Server	Indicates Error Condition
Error Packet	Customer's Internet Terminal	Indicates Error Condition

[0068] FIG. 7 is a flowchart for the Nationwide Routing Server software.

[0069] 1. Upon initialization, the Server's IP address is registered, and a UI window is displayed.

[0070] 2. The software goes into a wait state until a secure con-

nection request is received from the customer.

[0071] 3. TERMINATE means that the server is shutting down.

When it becomes necessary for the Nationwide Routing Server to shut down, the software waits for all threads to terminate, and then the application ends.

[0072] 4. A thread is a specific task in a multi-tasking environment. The number of threads that may run simultaneously is hardware dependent. An individual call request represents a single thread. The lifetime of a typical thread is approximately 500 milli-seconds. However, this is dependent upon TIME-OUT parameters which represent a design choice.

[0073] 5. Once a secure communication is established with the customer, the Nationwide Routing Server Software queries a database to locate the appropriate TRS Center.

[0074] 6. Once the appropriate TRS Center is located, a Status Request is sent to the TRS Center Packet Server.

[0075] 7. Once a *call accept* packet is received from the TRS Center Packet Server, the Nationwide Routing Server Software issues a *call accept* packet to the customer.

[0076] 8. The Nationwide Routing Server's job with the particular customer is now complete, and the thread is terminated.

[0077] TRS PACKET SERVER SOFTWARE:

[0078] The TRS Packet Server Software essentially acts as a broker for messages sent between the Customer's Internet Terminal Application and the TRS Operator Platform Software. It also contains the queue of available TRS Operators and sets the queue threshold. A key feature of this system is the ability to keep several TRS Operators available to receive calls through the Public Switched Network (PBX). In order for calls placed through the Public Switched Network to receive priority, a higher queue threshold is set in the TRS Packet Server than the PBX. The following is the detail on how this system works.

[0079] 1. A TRS Agent logs into the TRS Operator Terminal.

[0080] 2. The TRS Operator Terminal sends a Make Available message to the PBX. This allows the TRS Operator to start receiving calls through the Public Switched Network. This step is only used for operators who are trained to handle TRS calls through the Public Switched Telephone Network.

[0081] 3. The TRS Operator Terminal sends a Make Available message to the TRS Packet Server. This allows the TRS to start receiving calls from Internet Customers. This step is only used for operators who are trained to handle Internet TRS calls.

[0082] 4. The TRS Packet Server will only send a new call to a TRS

Operator if there are more than the threshold number of operators available in queue. Otherwise, the TRS Server will report No Operators Available back to the Nationwide Routing Server in response to a Status Request Packet.

[0083] 5. If a PBX call is received at the position, a Position Busy message is sent to the TRS Packet Server to remove the position from the queue to receive new calls from Internet customers.

[0084] 6. If an Internet Relay Call is received at a TRS Operator position, a Position Busy message is sent to the PBX to remove that operator position from the PBX queue.

[0085] 7. When the TRS Agent logs out of the position, a Position Busy message is sent to both the PBX and to the TRS Packet Server to prevent the TRS Operator from receiving new calls.

[0086] The following tables lists the messages that the TRS Packet Server Software processes:

Receive Packets

Message Type	Received From	Description
Status Request	Nationwide Routing Server	Requests if there are TRS Operators Available above the queue threshold
Position Available	TRS Operator Position	Place TRS Operator Position in queue
Position Busy	TRS Operator Position	Remove TRS Operator Position from queue
Establish Secure Connection	Customer's Internet Terminal Application	Request to establish secure connection
Dial Request Packet	Customer's Internet Terminal Application	Packet is forwarded to TRS Operator Position
Customer Data Packet	Customer's Internet Terminal Application	Packet is forwarded to TRS Operator Position
TRS Operator Data	TRS Operator Position	Packet is forwarded to Customer's Internet Terminal Application
Hang-up Acknowledgement	TRS Operator Position	Packet is forwarded to Customer's Internet Terminal Application
Acknowledgement	Customer's Internet Terminal Application or TRS Operator Position	Acknowledgement packet
Error Packet	Customer's Internet Terminal Application or TRS Operator Position	Error condition

Transmit Packets

Message Type	Sent To	Description
Status Reply	Nationwide Routing Server	Reports number of available operators above the queue threshold.
Call Accept Packet	Customer's Internet Terminal Application	Informs customer that call has been placed.
Secure Connection Established	Customer's Internet Terminal Application	Confirms that a secure connection has been established
Log-off Acknowledgement	Customer's Internet Terminal Application	Confirms that outbound party has hung-up
Customer Data Packet	TRS Operator Position	Packet is forwarded to TRS Operator Position
TRS Operator Data	TRS Operator Position	Packet is forwarded to TRS Operator Position
Acknowledgement	Customer's Internet Terminal Application or TRS Operator Position	Packet Acknowledgement

[0087] FIG. 8 is a flowchart for the TRS Packet Server software.

[0088] 1. Upon initialization, the IP address is registered and a UI window is displayed.

[0089] 2. The software processes incoming message requests.

[0090] 3. TERMINATE means that the server is shutting down.

When it becomes necessary for the TRS Packet Server to shut down, the software waits for all threads to terminate, and then the application ends.

[0091] 4. There are three types of message requests:

[0092] a. status requests;

[0093] b. requests to establish a secure connection with a customer; and,

[0094] c. login requests from the Operator Stations.

[0095] TRS OPERATOR PLATFORM SOFTWARE:

[0096] The TRS Operator Platform Software is pre-existing in the TRS Centers. In order to add Internet Access, a modification is required to process TCP packet messages between the TRS Packet Server and the TRS Operator Platform Software. The following tables lists the new messages that the TRS Operator Platform software needs to process:

Receive Packets

Message Type	Received From	Description
Status Request	TRS Packet Server	Requests Operator Status
Establish Secure Connection	TRS Packet Server	Request to establish a secure connection
Dial Request Packet	TRS Packet Server	Contains the phone number that the customer is requesting the TRS Operator to dial
Customer Data Packet	TRS Packet Server	Contains information or conversation text typed by the customer
Hang-up Request Packet	TRS Packet Server	Customer Requests that Operator Disconnects the outbound party
Acknowledgement	TRS Packet Server	Packet Acknowledgement
Error Packet	TRS Packet Server	Checksum or other error information

Transmit Packets

Message Type	Sent To	Description
Status Reply	TRS Packet Server	Reports Operator Status
Position Available	TRS Packet Server	Places the TRS Operator Position in queue to receive calls
Position Busy	TRS Packet Server	Removes the TRS Operator Position from the queue to receive calls
Secure Connection Established	TRS Packet Server	Confirms that a secure connection is established
Call Accept Packet	TRS Packet Server	Confirms that the outbound party's number has been dialed by the TRS Operator
Outbound Customer Data Packet	TRS Packet Server	Contains the conversation text of the outbound (voice) customer typed by the TRS Operator
TRS Operator Data	TRS Packet Server	Contains information text typed by the TRS Operator
Log-off Acknowledgement	TRS Packet Server	The outbound party has been released by the TRS Operator
Acknowledgement	TRS Packet Server	Packet Acknowledgement
Error Packet	TRS Packet Server	Checksum or other error information

[0097] The format of each packet is as follows: <Message Type> <Checksum> <Data Field Length> <Data Field>

[0098] The Message Type is a two-byte field that defines a unique message type. The Checksum is a four-byte hex field representing the checksum of the Data Field. The Data Field Length is a two-byte hex field representing the

length of the Data Field. The Data Field is a variable length (1–255 bytes) field containing the data.

[0099] The checksum of the Data Field of each packet and compared against the Checksum Field of the packet. Any errors are reported back to the sender by means of an Acknowledgment message. Also, Acknowledgment messages are used to acknowledge each Customer Data Packet received by the TRS Operator Platform Software. Acknowledgment messages are also sent from the Customer's Internet Terminal Application to the TRS Packet Server Software to acknowledge each TRS Operator Data packet.

[0100] FIG. 9 is a flowchart for the modifications to the currently existing TRS Operator Platform software.

[0101] 1. The operator logs onto the login screen at the terminal.

[0102] 2. The application permits the operator to log onto the PBX at the TRS Center (the existing application) or onto TRS Packet Server (the present invention) or both (the present invention). These are two separate call queues.

[0103] 3. If the operator logs onto both queues, he or she is able to handle calls from both. However, if a call comes in from either one of the queues, the application logs the operator off from the other queue.

[0104] The present invention has been successfully tested.

[0105] KEY ADVANTAGES OF THE NEW SYSTEM:

[0106] – Public Switched Telephone Network calls to the TRS Center are given priority over Internet Relay calls by virtue of the queue threshold in the TRS Packet Server.

[0107] – System can be added to existing TRS Relay Centers to add Internet Relay functionality. This provides a cost saving to the TRS provider

[0108] – Operators need only log into the PBX from the TRS Operator position to handle Public Switched Telephone Network calls if they have only been trained in handling traditional TRS calls.

[0109] – Operators need only log into the TRS Packet Server from the TRS Operator position to handle Internet Relay TRS calls if they have only been trained in handling Internet Relay TRS calls.

[0110] – The same TRS Operator positions and equipment can handle traditional TRS calls and Internet Relay calls.